

I-77 Feasibility Study (I-85 to Griffith Street)

TIP Project No. FS-0810B

Task Order No. 1 – I-77 Widening & HOV Facility Extension

Sub-task 1.B, Performance Measures

Task Order No. 2 – I-77 HOV/HOT Conversion

Sub-task 2.B, Performance Measures

TECHNICAL MEMORANDUM

(FINAL)

June 22, 2009

1.0 INTRODUCTION

A Performance Monitoring Plan was developed for the I-77 high occupancy vehicle (HOV) facility which opened in 2004 between Brookshire Freeway and I-485 north of Charlotte. The Plan's purpose was to respond to HOV lane project objectives and track performance of the I-77 HOV operation in response to those objectives. The purpose of performance monitoring was to fine-tune the facility's operation, design, rules and regulations through a modest data collection effort. In January 2006, a report was prepared to document the effectiveness and impacts of North Carolina's first HOV lane project. Data was collected by various agencies both before and after the I-77 HOV facility was implemented. Information in this report was compared to baseline data collected in October 2004 to indicate how well the lanes were meeting approved objectives.

This sub-task under Task Order 1 involves a review of the original objectives adopted for HOV lane implementation along I-77, and the corresponding performance measures, to confirm if they are still applicable for the proposed HOV lane extension north to Griffith Street (Exit 30 at Davidson). Under sub-task 2.B in Task Order 2, these objectives and performance measures were reviewed and updated to reflect the possible conversion of the I-77 HOV facility to high occupancy toll (HOT) lanes.

Section 2.0 describes objectives associated with the current HOV lane and how an HOV extension and HOT conversion would pivot off of these objectives.

Section 3.0 provides the evaluation framework for measures of effectiveness and data sources to be used in future analysis of I-77 managed lanes.

2.0 PROPOSED OBJECTIVES

The objectives of the I-77 HOV Lane Project were:

- Move more people by increasing the number of persons per vehicle.
- Reduce travel time and ensure reliable trip times for HOVs using the I-77 HOV lane facility.
- Operate a safe HOV facility and not unduly impact the safety of the I-77 general-purpose lanes.
- Maintain or improve public support for the I-77 HOV facility.

Experience since the I-77 HOV lanes opened indicates that another objective that should be considered is managing violations that are present on the HOV lanes in order to help maintain public respect and acceptance. The ability to enforce HOV compliance along I-77 is limited by the facility's design (the HOV lanes are not physically separated from adjacent traffic) and by the lack of dedicated enforcement for I-77 HOV lane operations beyond the initial start-up period in 2004-2005. Enforcement experience along I-77 prompts the addition of another performance measure in order to monitor and improve compliance of HOV lane regulations.

Under Task Order 2 of the I-77 Feasibility Study, vehicle throughput on the HOV lanes is addressed by attempting to move more people and more vehicles based on current levels of use through the application of variable pricing for single-occupant vehicles. Tolling is new to the Charlotte region and the state. Task Order 2 seeks to test variable pricing in this environment and determine if it is feasible on the state's first HOV lane project. If found feasible, the I-77 HOV facility would be converted to HOT lanes and would still give preference to HOVs but allow SOVs to buy into the lane so long as operational capacity is available. In order to accomplish this conversion, the following objectives are proposed to be added to those adopted for the I-77 HOV lanes:

- Move more vehicles than would otherwise be carried by the HOV lanes while not adversely impacting potential person-moving potential.
- Demonstrate variable pricing as a cost-effective means of improved lane management.

The latter objective needs to be considered in the broader context of what the pricing policy should be for the Charlotte region's first demonstration. For example, should pricing only be applied as a management tool to fill up lane capacity (which may only generate a limited revenue stream), or should pricing be applied in response to a goal of optimizing revenue? These different pricing goals are a subset of the above objective that needs to be defined prior to evaluating pricing concepts and may need further clarity based on findings generated from the study evaluations.

The proposed objectives for Task Orders 1 and 2 of this feasibility study include:

- ***Increase mobility in the I-77 corridor*** by moving more persons per vehicle (Task Order 1) and more vehicles than the number presently being carried in the HOV lanes while not impairing person movement (Task Order 2).
- Reduce travel time and ensure reliable trip times for all eligible users for an HOV lane extension (Task Order 1) and a HOT lane conversion of I-77 HOV lanes (Task Order 2).
- Operate a safe managed lane facility (HOV or HOT) and preserve the safety of the I-77 general purpose lanes (Task Orders 1 and 2).
- Test acceptance and maintain or improve public support for an HOV lane extension (Task Order 1) or the I-77 HOT facility (Task Order 2).
- Improve enforcement compliance (Task Orders 1 and 2).
- Demonstrate variable pricing as a means of improved lane management (Task Order 2).

3.0 PROPOSED MEASURES OF EFFECTIVENESS

In order to assess each objective quantitatively, measures of effectiveness (MOEs) are applied based on available traffic and design data and projected conditions.

In 2003 and 2004, based on the objectives discussed in Section 2, the I-77 HOV Operations, Education & Outreach Committee – an interagency committee established to coordinate HOV activities among various branches of the North Carolina Department of Transportation (NCDOT), the Federal Highway Administration (FHWA), the City of Charlotte, the contractor and designer for I-77 improvements, and enforcement agencies – used a variety of planning measures to evaluate the physical and operational characteristics of the I-77 HOV lanes including physical attributes of the corridor, access needs, demand, safety, operational restrictions and enforcement needs. These criteria helped create the design and operational concept for the project. This Committee also approved the following MOE performance measures for evaluating the I-77 HOV facility after it opened:

- **Operations** – total person throughput, travel times for HOVs and single occupant vehicles, safety, and traffic operations at the beginning and ending transitions.
- **Modal Impact** – HOV lane use, transit ridership, number of persons per vehicle, vanpool use.
- **Public Acceptance** – Public perceptions of success. Various sources of input included survey results, phone calls, internet email comments to agencies, etc.

3.1 HOV LANE EXTENSION (TASK ORDER 1)

A revised set of planning level data associated with an I-77 HOV lane extension in Task Order 1 would include:

- **Design** – Ability to add an HOV lane to the existing roadway, costs and impacts associated with the lane addition.
- **Operations** – HOV and total corridor person throughput, travel times (savings) for HOV users and general purpose traffic, and forecast traffic operations at the beginning and ending transitions.
- **Enforcement Compliance** – Ability and commitment of law enforcement agencies to enforce HOV restrictions and achieve a desired compliance rate.
- **Public Attitudes** – Public perceptions of what would constitute project success. This would include survey results, phone calls, internet email comments, etc.

Table 1 provides a list of MOEs which will be applied to each objective using the above data sources.

Table 1: Matrix of HOV Lane Objectives, MOEs and Data Sources

Objective	Measures of Effectiveness (MOEs)	Data Source
Increase mobility by moving more persons per vehicle	Forecast HOV demand compared to general purpose demand, existing and forecast years	HOV and total corridor person movement demand
Reduce travel time and ensure a more reliable trip	Comparative travel times between HOV and general purpose lanes, existing and forecast years	HOV and general purpose travel times
Operate a safe facility	Compliance in meeting desired and acceptable design-lane and shoulder widths	Corridor as-built plans compared to concept plans to create HOV lane
	Access needs	HOV demand
	Transitions at termini-impacts to general purpose traffic	HOV and general purpose demand and weaves created by HOV lane concept
	Operation restrictions	HOV demand
	Design exceptions	Corridor as-built plans to create HOV lane concept
	Costs and environmental impacts	Cost estimates and identified environmental issues
	Incident frequency & duration <i>(to be used in assessing ingress/egress, types of lane separation, etc.)</i>	Incident logs, TIMS & law enforcement records
	Crashes, crash rate & injury severity (before & after) <i>(to be used in assessing ingress/egress, types of lane separation, etc.)</i>	Law enforcement DMV 349 reports and Mobility & Safety's Traffic Safety Systems Section (for crash data & analysis)
Enforcement compliance	Ability to provide enforcement areas	Corridor as-built plans to create HOV lane concept
	Commitment from law enforcement and judicial (judges/district attorneys, adjudication, etc.) agencies	Input from law enforcement and judicial agencies
	Dedicated funding availability (if required)	Input from Technical Steering Committee
	Observed compliance	Surveys, video surveillance and sampling
Public support	Agency attitudes	Technical Steering Committee feedback
	Public attitudes	External agency feedback and public comments received by Technical Steering Committee

3.2 HOT CONVERSION (TASK ORDER 2)

The following evaluation input would be associated with HOT lane conversion of the I-77 HOV lanes in Task Order 2:

- **Operations** – Demand for HOV, HOT users and general traffic, travel times (savings) for HOT users and general traffic and traffic operations at the beginning and ending transitions.
- **Modal Impact** – Changes in HOV or transit ridership
- **Variable Pricing Effectiveness** – Demand for tolled users, costs and revenues associated with adding variable pricing to the existing HOV lanes
- **Enforcement Compliance** – Ability to fund dedicated enforcement from revenues and develop an enforcement strategy satisfactory to the affected law enforcement agencies.
- **Public Attitudes** – Public perceptions of what would constitute project success. This would include survey results, phone calls, internet email comments, etc.

Table 2 provides a list of MOEs which will be applied to each objective using the above data sources.

Table 2: Matrix of HOT Lane Objectives, MOEs and Data Sources

Objective	Measures of Effectiveness (MOEs)	Data Source
Increase mobility by moving more vehicles	Forecast HOT demand compared to general purpose demand, opening year and forecast years	HOV, tolled SOV and total corridor vehicle demand
Reduce travel time and ensure a more reliable trip	Comparative travel times between HOT and general purpose lanes, opening and forecast years	HOT and general purpose travel times
Modal impact	Comparison of before/after HOT lane facility opening on modes	HOV and transit forecast demand SOVs in HOT and general purpose lanes
	Comparison of before/after HOT lane facility opening on travel times	Travel time changes in HOT lane
Variable pricing effectiveness	Toll demand, opening and forecast years	HOT vehicle demand
	Revenues	Forecast revenues associated with tolling scenarios and objectives
	Costs for variable pricing installation and related improvements to signing and lane designs	Estimated capital costs
	Ongoing annual operation and maintenance costs (O&M)	Estimated O&M costs
Operate a safe facility	Access needs	HOT demand
	Transitions at termini-impacts to general purpose traffic	HOT and general purpose demand and weaves created
	Operation plan (user restrictions and requirements)	Conceptual HOT lanes operation plan (ConOps-Task 2.D)
	Implementation conversion issues	Conceptual HOT lanes operation plan (ConOps-Task 2.D)
Enforcement compliance	Ability to provide enforcement	Changes (if any) to HOV lane and enforcement equipment/technology required for the tolling concept
	Commitment from law enforcement and judicial agencies	Input from law enforcement and judicial agencies
	Dedicated funding availability (if required)	Revenue from tolls required (component of O&M)
	Observed compliance	Surveys, video surveillance and sampling
Public support	Agency attitudes	Technical Steering Committee feedback
	Public attitudes	External agency feedback and public comments received by Technical Steering Committee